Physics at the Energy Frontier

The DØ Experiment

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Outline

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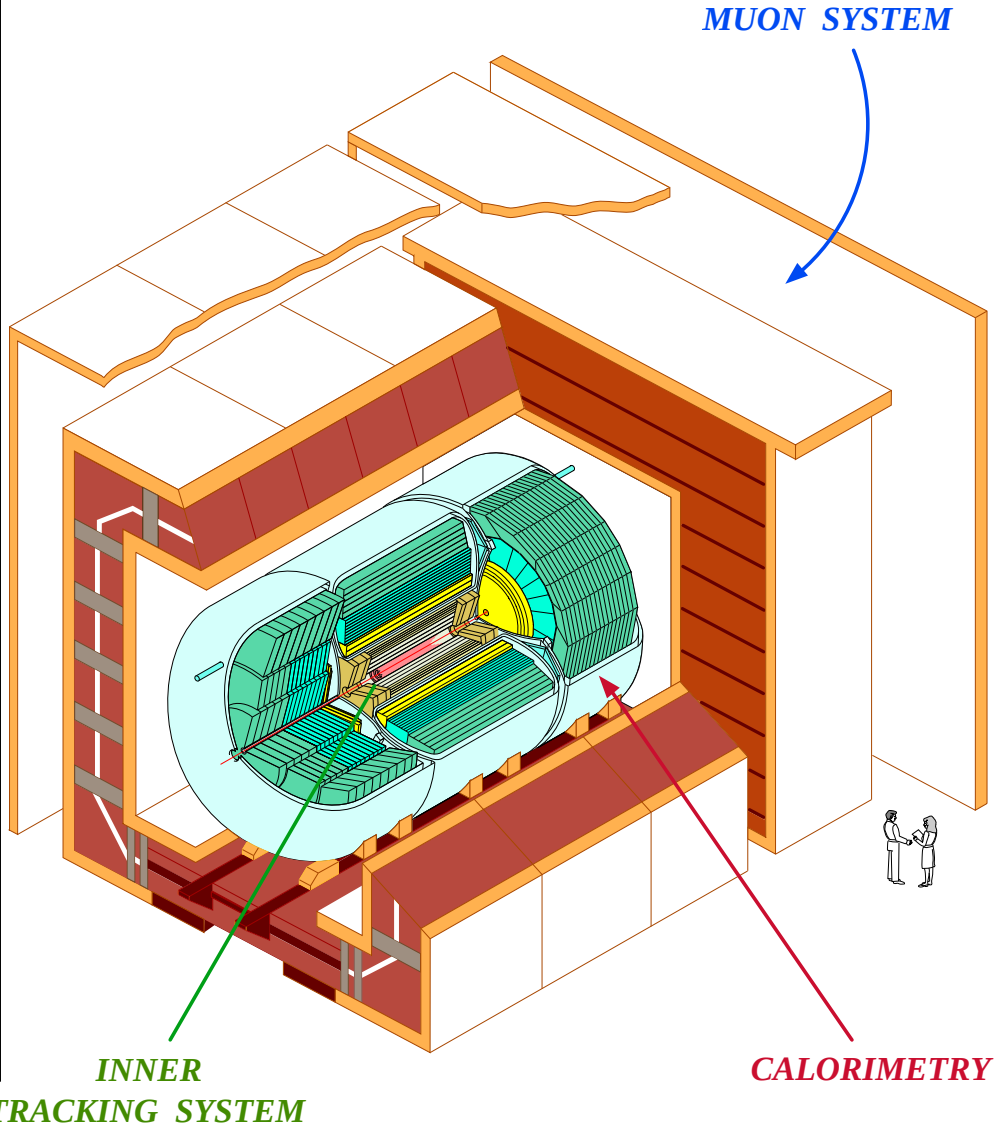
Introduction: Investigators

- Dugan O'Neil. PI. New faculty member at Simon Fraser University (SFU). Spent last 3+ years as RA at FNAL working on DØ . Previously did PhD at Victoria as part of the ATLAS collaboration.
- Mike Vetterli. Senior faculty member at SFU/TRIUMF. Former PI of Hermes project grant. Currently SFU PI for ATLAS. One of the Westgrid project leaders.

Intro: The DØ Experiment

- General-purpose experiment at the Tevatron.
  - Proton-antiproton collisions at 1.96 TeV
  - Currently taking data (Run II). Physics goals include
    - SUSY, extra-dim, other new phenomena
    - SM Higgs search
    - Properties of the top quark
    - Properties of W/Z
    - QCD
    - B-physics

Intro: The DØ Experiment -2



- 800k channels of silicon
- Scintillating fibre tracker, 2T magnetic field
- LAr/Ur calorimeter
- Standalone muon system

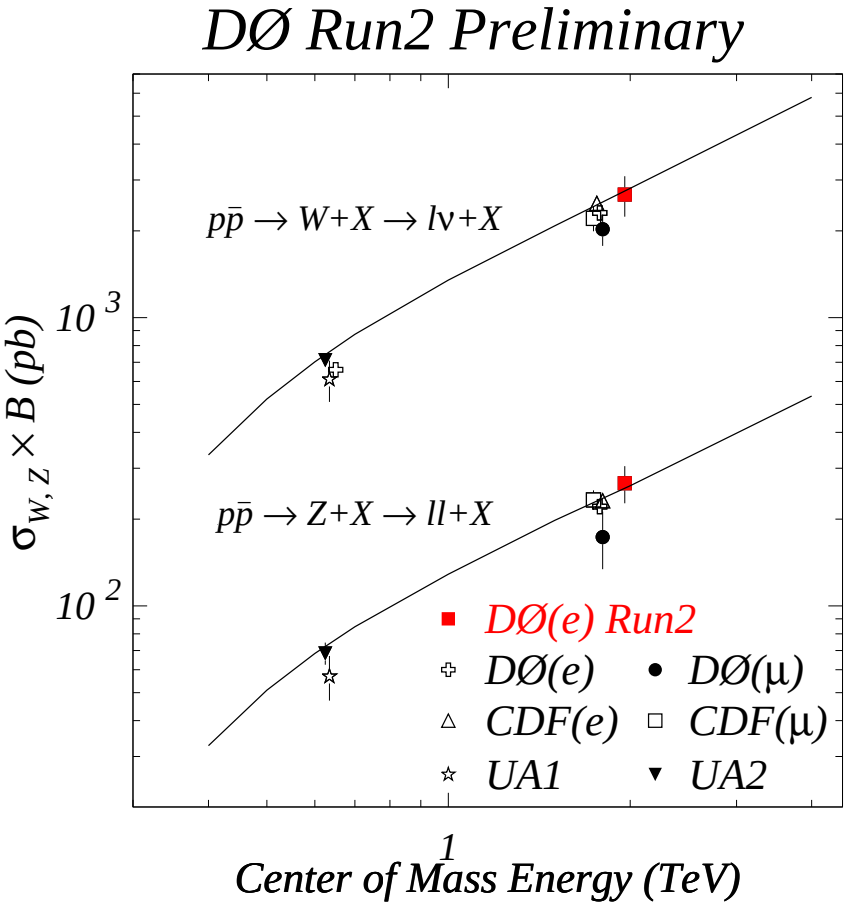
Status of DØ - Luminosity

- Data since April 2001. Emphasis on commissioning for first year. Data since summer 2002 is physics quality.
- Delivered luminosity has improved significanly in the last six months. Most of the data ($\sim$75%) taken so far has come in since the June 2002 shutdown.
- DØ weekly data taking efficiency is now 85%. Continues to improve.
- Collected 80pb^{-1} of physics data with full instrumentation.

Status of DØ - Physics

- Progress in physics results
  - Moriond 2002 - 1 pb^{-1} - detector works!
  - ICHEP 2002 - $>$5pb^{-1} - First RunII physics
  - Moriond 2003 - $>$50pb^{-1} - Top, W/Z, NP, B
  - Summer 2003 - 200pb^{-1}?? - Run I $\times 2$
- Goals/Expectations for Moriond 2003
  - $t\bar{t}$ cross-section at 1.96 TeV, top mass
  - W, Z production cross-sections. W+jets, Z+jets cross-section.
  - More limits in extra-dimensions, LQ, etc.

Status of DØ - Physics



- Have already graduated 4 PhD students using RunII data.
- W/Z cross-sections
- Limits on extra-dim, lepto-quarks.
- extra-dimensions in $\mu\mu$ channel first results from hadron collider.

Canadian Contribution - Computing

- Currently no official Canadian participation in DØ
- D. O'Neil has been a member of DØ for more than 3 years. Interests have been top quark, trigger system and offline computing.
- First Canadian impact will be in computing. Use a portion of the Westgrid compute farm for DØ data reprocessing/analysis and MC production. Constitutes Canada's "buy-in" to the experiment.
- SFU group has considerable expertise with DØ data handling software, linux, compute farms, etc. M. Vetterli is a project leader for Westgrid. It is a natural fit.

Canadian Contribution - Computing

- DØ has history of reliance on offsite compute resources. All DØ Run II MC has been produced offsite (mainly Europe). Stored at FNAL.
- Next step: Regional Analysis Centers (RAC). Plan for multi-tiered compute/storage centers.
  - Copy of the data served for “local” analysis.
  - Data reprocessing at RAC a key component of DØ model. Also MC production.
  - First RAC now up and running at GridKa (Karlsruhe). Every event taken by DØ in the last several months has been automatically copied to GridKa.

Canadian Contribution - Computing

- Benefits for Canadian Particle Physics
  - Use existing facility to gain free entry into an exciting experiment taking data (no new money for buy-in).
  - Immediate impact. RAC is already a proven concept. SFU already has skilled personnel. We can be reprocessing real data for conferences in a few months!
  - Training for ATLAS. Transfers of large quantities of data for storage and processing in multi-tiered structure is best training for our intended role in ATLAS. This HAS to work.

Personnel

- One RA posted at FNAL. Canadian contribution to computing requires software development and management responsibilities. Presence at FNAL as a liason to computing division expertise, coverage of shift-duties, etc.
- 2 students in the first year. Real data at highest energies! Potential for discovery! Training ground for ATLAS analyses.

Budget

- Inputs include
  - Salaries of RA ($45000) and graduate students ($16500).
  - Travel to FNAL for collaboration weeks, shifts: $\approx$ $2200/1wk trip, $\approx$$5300/3wk trip.
  - COLA for RA at FNAL: $15000.
  - Conference travel, PCs, summer student (year 2), materials.

Summary

- DØ is taking high-quality physics data! Exciting programme filled with opportunity for quality measurements and training of graduate students.
- Canada can make an immediate impact on the success of the experiment with support of the SFU group. Computing facilities and expertise are in place already! Data processing in Canada this year!
- Request is primarily funding for 1 RA at FNAL and two graduate students based at SFU.

Prepared Questions

Could you elaborate on why the group cannot pursue their physics program with CDF, since here is an established and powerful group in Canada with similar interests in computing?

Prepared Questions

- The decision to join DØ was based on
  - immediacy of impact
  - compatibility of our technical contribution with the experiment's needs and plans.
  - DØ as a training ground for ATLAS. Physics, detector, computing.

Prepared Questions - impact

- Start time greatly reduced by in-house experience with DØ software and personnel.
- Continued strong involvement in top group/analysis. D. O'Neil already a Run II author.
- Offsite computing contributions explicitely recognized. M. Vetterli an author in 1 year.
- Immediate positions of responsibility for both. Editorial boards, Offsite analysis task force, computing policy board, software management.
- DØ management has been extremely keen on securing our entry.

Prepared Questions - Technical

- DØ plans to get 50% of analysis computing needs, 100% of data reprocessing and 100% of MC production from offsite resources. Always has relied heavily on remote contribution.
- Computing model concept of RAC fits nicely with Westgrid contribution. “Free” entry to the experiment. Excellent access to data and resources.
- A member of the SFU team is an author of the DØ computing 5-year plan. Expertise in DØ datahandling software. We already know how to make a RAC!

Prepared Questions - Training

- DØ and ATLAS have a lot in common
- Detector: Robust design for high-luminosity
  - Excellent LAr calorimetry.
  - Standalone muon system with excellent coverage.
- Computing environment:
  - Offsite computing an essential component of model for Run II.
  - Experience with offsite MC production, development of data handling and cataloguing software.

Prepared Questions - Summary

- We are building a new HEP group at SFU. We carefully considered the CDF option before deciding that our interests were best served by joining DØ .
- What about the greater good? Canada's interest?
  - We believe we can have an immediate impact at DØ . This is strongly supported by experiment management. "Free" buy-in.
  - We believe that DØ is an EXCELLENT training ground for ATLAS (physics, detector and computing).